(11) Patent Kokai [laid-open] Publication No. : Hei 11[1999]-333732

(12) PATENT KOKAI PUBLICATION (A)

(19) JAPANESE PATENT OFFICE (JP)

(21) Patent Application No. : Hei 10[1998]-162827

(22) Patent Application Date : May, 28, 1998

(43) Patent Kokai Publication Date : December 7, 1999

(51) Int. Cl.[6]	ID Codes	FI	
B 24 D 11/00		B 24 D 11/00	B
			Q
C 09 D 131/04		C 09 D 131/04	Z

Numbers of Claim Items : 5 FD (Total 8 pages in Japanese original)

Examination Request : Not Requested

(54) [TITLE OF THE INVENTION]
POLISHING TAPES AND COATING SOLUTION FOR THE SAME POLIISHING TAPES, AND MANUFACTURING METHOD OF THE SAME POLISHING TAPES [Kenma tape oyobi kenma tapeyo tokoeki narabini, kenma tape no seizohoho]

(57) [ABSTRACT]
[SUBJECT]
According to polishing tapes which are for precision parts members, it offers polishing tape that does not cause grinding scratches during grinding, and is suited for a final finish with durability.

[MEANS OF SOLUTION]
The polishing tape (4) having a polishing layer (7) that is arranged on one side of a base film (5) , and has mesh-form cracks (20) of which average roughness (Ra) at surface center line of non-crack parts (30) of said polishing layer (7) is 0.005 ~ 1.0 μm, and pitch of 5 ~ 200 μm; and this is constructed of silica particles which are the fine abrasive particles (20) of said polishing layer (7) of which average particle diameter being 0.005 ~ 0.03 μm, and a binder comprising copolymer , prepolymer, or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding..

1: about 100 μm

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[Amendments: There are no amendments to this patent.]

[note: All names, addresses, company names, and brand names are translated in the most common manner. Japanese language does not have singular or plural words unless otherwise specified with numeral prefix or general form of plurality suffix. The original document of this patent particularly displays much complex syntax and lengthy sentences indicating subject terms and object terms can be translated in varieties of manner. Translator's note]

[CLAIMS]

[CLAIM ITEM 1]

A polishing tape having a polishing layer that is arranged on one side of a base film, and has mesh-form cracks of which average roughness (Ra) at surface center line of non-crack parts of said polishing layer is 0.005 ~ 1.0 μm, and pitch of 5 ~ 200 μm wherein said polishing tape is constructed of silica particles which are the fine abrasive particles of said polishing layer of which average particle diameter being 0.005 ~ 0.03 μm, and a binder comprising copolymer, prepolymer, or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding.

[CLAIM ITEM 2]

A coating solution for polishing tapes that has characteristics as such that the abrasive agent of coating solution that form above-explained polishing layer being organo silica sol with 0.005 ~ 0.03 μm , and in addition, binder being a copolymer, or prepolymer, or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding.

[CLAIM ITEM 3]

The coating solution for polishing tapes according to the claim item 2, wherein weight ratio of said abrasive particles and binder being 1:99 ~ 99:1.

[CLAIM ITEM 4]

A polishing tape having a polishing layer that is arranged on one side of a base film, and has mesh-form cracks of which average roughness (Ra) at surface center line of non-crack parts of said polishing layer is 0.005 ~ 1.0 μm, and pitch of 5 ~ 200 μm; and abrasive agent of the coating solution that forms polishing layer of said polishing tape of which polishing layer is constructed of silica particles with 0.005 ~ 0.03 μm average particle diameter and a binder comprising a copolymer, or prepolymer, or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding being organo silica sol with 0.005 ~ 0.03 μm; and in addition, manufacturing method of the same polishing tape has characteristics as such that adjustment is made to show 15 ~ 85 weight % nonvolatile component of the coating solution for polishing tape of which binder being a copolymer, or prepolymer, or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding in which weight ratio of said abrasive particles and binder is 1:99 ~ 99:1; and this is coated on the base film by a gravure reverse coating method or a kiss reverse coating method to give 3 ~ 8 g/m^2 (by solids); and then, this is heated immediately after to evaporate solvent, and then, a curing reaction of the binder and crack formation are completed to form said polishing layer.

[CLAIM ITEM 5]

The manufacturing method of polishing tape according to the claim item 4, wherein said polishing layer is formed by first filtering the coating solution described in the claim item 4 with a filter of 1 ~ 10 μm, and by coating this and drying on the base film in a coating section of which atmosphere is held at 30 ~ 40°C and relative humidity 20 ~ 60% under said temperature, and by further subjecting this to a heat treatment at 40°C, for over 300 hours to complete the reaction.

[CLAIM ITEM 6]

The manufacturing method of polishing tape according to the claim items 4 ~5, wherein said polishing layer is formed on a primer layer that is arranged on the base film.

[DETAILED EXPLANATION OF THE INVENTION]

[0001]

[TECHNICAL FIELDS OF THIS INVENTION]

This invention relates to polishing tapes, a coating solution for polishing tapes, adjustment and manufacturing method of the same coating solution for polishing tapes, and manufacturing method of the same abrasive tapes which are used for finial finish on surfaces or end planes of precision parts members such as optical connector ferule, semiconductor wafer, ceramics, color filter for liquid crystal display, plasma display, optical glass, optical lens, magnetic disc or optical disc substrate, magnetic head, or optical read head.

[0002]

[PRIOR ART]

Regarding the precision parts member, for instance, in the case of an optical fiber or a semiconductor wafer, it is processed through polishing process comprising plural number of stages; and its quality is dominated by the precision of the polishing process that conducts its final mirror surface finish. In addition, final finish polishing is conducted through a joint use of polishing solution and polishing cloth that is referred to as mechanical polishing. Furthermore, because above-explained method that uses polishing solution is complex for its polishing process, a method that uses a polishing tape is considered as the method that takes place of said method. According to this polishing tape, a coating solution prepared by dispersing abrasive particles in a binder (this is used to anchor abrasive particles to a base film, and it consists of synthetic, natural resin, plasticizer, lubricant, or antistatic charge agent and the like) in a varnish that is dissolved in a solvent that is suited for a coating process is coated on a base film for polishing tape that is mainly formed of plastic, and this is dried, and reaction such as curing is promoted and completed as needed to form a polishing layer.

[0003]

Regarding the particles of abrasive agents which are used for a polishing tape for precision parts members, fine silica particles of 0.01 ~ 0.02 μm are used, and the one of which plane is finished to be as flat and smooth as possible has been studied. However, polishing tape of which surface is finished flat and smoo0th through use of fine particles displays a problem point that it cannot provide a sufficient grinding force. In addition, when particle diameter of abrasive agent is made small, content that can be compounded in the coating solution becomes large; and it is necessary to reduce the content as the particle diameter becomes larger. In addition, when it happens to be smaller than 0.001 μm, it is not possible to improve grinding effect; and when it happens to be larger than 0.7 μm, it may cause scratches on a to-be polished agent.[note: although original document states the term agent, may be a misprint of material. translator's note]. And therefore, particles of 0.001~ 0.7 μm have been used favorably. However, when fine particles with larger than 0.7 μm are used for the polishing tape for precision parts members which require a surface finish of much finer level of "nm unit", grinding scratches on the surface become defects to cause significant decline in finish precision, for instance, decline in signal decay characteristics in the case of polishing optical connector ferule.

[0004]

[SUBJECTS SOLVED BY THIS INVENTION]

A polishing tape that uses fine silica showing average particle diameter of 0.005 ~ 0.03 μm as the abrasive particles , and its surface is close to a flat state can be considered. However, the polishing tape that uses said super fine silica particles as abrasive agent only cannot provide a satisfactory grinding force, and in addition, conventional polishing tapes may not only apply scratches on the surface of to-be polished layer due to grinding wastes but also, cannot maintain grinding force over long hours.

[0005]

Based on consideration given on above-explained defects or problem points, the purpose of this invention's polishing tape is to enable to conduct a mirror surface finishing with good precision on the precision parts members such as end plane of optical connector ferule or semiconductor wafer surface by using super fine silica particles of 0.005 ~ 0.03 μm with good grinding efficiency without causing grinding scratches. [note: original document uses the term grinding scratches for this portion, and polishing scratches at latter portion. Translator's note] In addition, its subjects are polishing tapes with improved wettability through arrangement of mesh form cracks on the surface of a polishing layer to reduce decline in signal decay characteristic and to collect grinding wastes with the tape, and coating solution for said polishing tape, and manufacturing method the same polishing tape.

[0006]

[MEASURES USED TO SOLVE THE SUBJECTS]

The polishing tape that solves above-explained subjects is the one that has a polishing layer that is arranged on one side of a base film, and mesh-form cracks of which average roughness (Ra) at surface center line of non-crack parts of said polishing layer is 0.005 ~ 1.0 μm , and pitch of 5 ~ 200 μm; and this polishing tape is constructed of said polishing layer that includes silica particles of which average particle diameter is 0.005 ~ 0.03 μm, and a binder comprising a copolymer, prepolymer, or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding. In addition, according to the claim item of this invention, abrasive agent of coating solution that constitutes above-explained polishing layer is organo silica sol with 0.005 ~ 0.03 μm, and furthermore, it is the coating solution for said polishing tape of which binder is a copolymer, prepolymer, or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding with 500 ~ 1500 average molecular weight. In addition, according to the claim item 3 of this invention, it refers to the manufacturing method of coating solution for polishing tape of which weight ratio of said abrasive particles and binder is 1:99 ~ 99:1. Furthermore, according to the claim 4 of this invention, it refers to the polishing tape having a polishing layer that is arranged on one side of a base film, and has arrangement of mesh-form cracks showing average roughness (Ra) at surface center line of non-crack part of said polishing layer is 0.005 ~ 1.0 μm, and pitch of 5 ~ 200 μm; and manufacturing method of said polishing tape of which said polishing layer is constructed of silica particles with average particle diameter of 0.05 ~ 0.03 μm, and a binder comprising a copolymer, prepolymer, or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding; and the abrasive agent of the coating solution that form polishing layer of thus constituted polishing tape being organo silica sol with 0.005 ~ 0.03 μm, and in addition, binder being a copolymer, prepolymer, or oligomer of vinyl chloride-vinyl acetate having siloxane bonding, and nonvolatile component of coating solution for polishing tape showing 1:99 ~ 99:10 weight ratio of abrasive particles and binder is adjusted to 15 ~ 85 weight %; and this is coated on a base film through a gravure reverse coating method or a kiss reverse coating method to give 3 ~ 8g/m^2 (based on solids), and this is heated immediately after to evaporate solvent, and then, curing reaction of the binder and crack formation are completed to form said polishing layer. In addition, it refers to the manufacturing method of said polishing tape of which coating solution of said polishing layer is first filtered with a filter of 1 ~ 10 μm, and this is coated and dried on a base film in a coating section of which atmosphere is held at 15 ~ 40°C, and relative humidity of 20 ~ 60% under said temperature, and this is further subjected to a heat treatment at 40°C for longer than 300 hours to complete curing reaction. In addition, according to the claim 6 of this invention, it refers to the manufacturing method of polishing tape that further forms said polishing layer on a primer layer that is arranged on a base film.

[0007]
[EMBODIMENT OF THE INVENTION]
As illustrated in the Figures 1 (A) and (B), this invention's polishing tape (4) is the polishing tape (4) that has a polishing layer (7) that is arranged on one side of a base film (5), and has arrangement of mesh form cracks (70) of which average roughness (Ra) at surface center line of non-crack part (30) of said polishing layer is 0.005 ~ 1.0 μm, and pitch of 5 ~ 200 μm. In addition, it is the polishing tape (4) of which said polishing layer (7) is constructed of silica particles as fine abrasive particles (20) which show average particle diameter of 0.05 ~ 0.03 μm, and a binder comprising a copolymer, prepolymer or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding.

[0008]
In addition, the fine abrasive particles (20) of the coating solution that forms above-explained polishing layer (7) are of organo silica sol with 0.005 ~ 0.03 μm; and furthermore, it is the coating solution for polishing tape that consists of a low molecular weight binder showing average molecular weight of 500 ~ 1500 comprising copolymer, prepolymer, or oligomer of vinyl chloride-vinyl acetate group having siloxane bonding. In addition, it is the manufacturing method of coating solution for polishing tape of which said coating solution for polishing tape showing weight ratio of said abrasive particles (20) and binder being 1:99 ~ 99:1, or more preferably, 10:90 ~ 90:10.

[0009]
Said polishing layer (7) is prepared by adjusting nonvolatile component of said coating solution for polishing layer to 15~ 85 weight %, or more preferably, to 25 ~ 75 weight %, and by coating this on a base film (5) with a gravure reverse coating method or a kiss reverse coating method, and by heating immediately after to evaporate solvent, and then, drying and reacting the binder to form mesh-form cracks (70). In addition, it refers to the manufacturing method of polishing tape (4) of which polishing layer (7) is formed by first filtering said coating solution with a filter of 1 ~ 10 μm, and then, by coating and drying this on a base film in a coating section of which atmosphere is held at 15 ~ 40°C, and 20 ~ 60 % relative humidity under the same temperature, and by further subjecting this to a heat treatment at 40°C for longer than 300 hours to complete the reaction of the polishing layer, and at the same time, to remove distortion of the polishing layer that occurs during crack formation to form said polishing layer (7).

[0010]
Then, as illustrated in the Figure 3, it refers to the manufacturing method of polishing tape (4) that forms said polishing layer (7) on the primer layer (6) that is arranged on the base film (5).

[0011]
As illustrated in the Figure 1, regarding polishing tape (7), although it is possible to directly form said polishing layer (7) on the base film (5) comprising plastic film such as polyester with 50 ~ 100 μm thickness, it is recommended to form said polishing layer (7) after arranging a primer layer (6) on the base film (5) for purpose of reinforcement as well as stabilizing the adhesion of polishing layer (7) and base film (5) as illustrated in the Figure 3.

[0012]
As for the base film that is used for this invention's polishing tape, appropriate type may be selected among the films showing sufficient strength that withstands against polishing work, strength, heat resistance, which withstand against coating and drying of abrasive agent, and less dimensional changes. For instance, it refers to drawn or non-drawn films composed of polyolefin resins such as high density polyethylene or polypropylene and the line; or acryl resins having main components such as polystyrene, polyvinyl chloride, polyvinylidene chloride, polyvinyl alcohol, ethylene-vinyl alcohol copolymer, polyacrylonitrile, polyamide, ester acrylate, or ester methacrylate; or polyester such as polyethylene terephthalate, polybutylene terephthalate, or polyethylene naphthalate and the like, or cellulose derivatives such as di or tri cellulose acetate and the like; or polycarbonate.

[0013]
It is preferable when antistatic agents are added to the base film that is used for this invention's polishing tape from the standpoint of prevention against adhesion of dust powder. As for the antistatic agents, appropriate selection may be made for addition such as ordinary nonionic surfactant, anionic surfactant, cationic surfactant, or polyamide derivatives or acrylic acid derivatives.

[0014]
The base film may be selected from 25 ~ 200 μm thick biaxially drawn film of polyethylene terephthalate or Nylon 6 , or polyimide film showing excellent coating aptitude of polishing layer, post process aptitude as well as handling by a polishing machine . In addition, it is recommended to apply an easy adhesion treatment such as corona discharging treatment or ozone gas treatment to the side where primer layer or polishing layer is coated. Preferred base film include polyester with many varieties of raw material and are easy to denature; and in particular, it refers to the film with 20 ~ 200 μm [thickness] of a biaxially drawn film of polyethylene terephthalate showing heat resistance as well as rigidity, and has an arrangement of a primer layer of other polyester.

[0015]
Although primer layer suited for this invention's polishing tape varies in accordance to the types of base film, it may be formed by first coating a varnish having the main components of vinyl chloride-vinyl acetate group copolymer, acryl group resins such as polyvinyl acetal group resin, polyalkyl acrylate or polyalkyl methacrylate and the like, or their copolymers; ethylene group copolymers, rubber group derivatives, polyester group resins, polyamide group resins, phenol group resins, epoxy group resins, amino plast [transliteration], polyurethane group resins, or cellulose derivatives and the like on a either non-drawn or uniaxially drawn film, and then, by further applying a biaxial drawing treatment to strengthen adhesion strength between base film and primer layer, or by simply coating on a drawn film.

[0016]
Regarding the primer layer, after it is coated on a non-drawn film or uniaxially drawn film, it is subjected to a drawing process to allow primer layer to heat and melt on the film to strengthen adhesion of the base film and primer layer. In addition, said primer layer may be also formed by drawing process of co-extruded film as well besides said coating. For instance, as noted in polyethylene terephthalate and linear polyester (for example, polyester showing secondary transition point (Tg) of 40 ~ 130°C), or polypropylene and ethylene.vinyl acetate copolymer, a resin that becomes said primer layer showing difference (lower) crystallization temperature from that of the resin that becomes base film may be co-extruded to form a film, and then, it may be drawn to form a base film that shows good thickness precision and stable adhesion with a polishing layer.

[0017]
Regarding the primer layer that is arranged on a base film in order to provide a strong and stable adhesion of polishing layer and base film, besides varnish formed of the same type of material as above-explained binder, it is possible to prevent from blocking by coating said primer layer even though it may show some tack through the same process along with the polishing layer the primer layer. And therefore, it may be selected as the material that shows miscibility [familiarity] with the base film and strong adhesive force with low glass transition point to heat and cure at the same time of polishing layer after coating said polishing layer. In addition, the primer layer that maintains tack can also show a performance to adsorb polishing powder collected in the cracks. Furthermore, in some types of varnish explained above, adhesion may be further strengthened by adding hardeners such as isocyanate and the like.

[0018]

The abrasive particles used in this invention's polishing layer is the fine particles of organo silica sol showing average particle diameter of 0.005 ~ 0.03 μm. In general, as abrasive particles used for a polishing tape suited for precision parts members, primary particles of spherical shape showing 0.01 ~ 0.7 μm are used. And, when particle diameter of abrasive agent is smaller, content that is compounded is the coating solution becomes greater, and when particle diameter is greater, content must by reduced. In addition, when it happens to be smaller than 0.7 μm, it cannot enhance grinding effect; and when it happens to be greater than 0.7 μm, it may tend to cause scratches on the to-be polished agent [note: although original document states the term agent, may be a misprint of material. translator's note]. And therefore, particles of 0.01 ~ 0.7 μm have been used favorably. However, in the case of polishing tape for precision parts and members which require further super fine surface finish, use of fine particles of 0.001 ~ 0.002 μm has been also attempted. When such super fine particles are used, grinding property generally remains not sufficient, and shows a defect of not possible attainment of satisfactory polishing properties. This invention deals with this defect by constructing its polishing tape for precision parts members through a synergistic effect with mesh-form cracks formed on the binder of the polishing layer.

[0019]

Weight percentage of super fine silica particles and binder in the coating solution is 1:99 ~ 99:1, or more preferably, 10:90 ~ 90:10. When percentage of particles happens to exceed 99 weight %, particles tend to fall off, and when it does not reach 1 weight %, effect of grinding cannot be displayed.

[0020]

In order to uniformly disperse fine particles showing 0.005 ~ 0.03 μm average particle shape [note: although the original document uses the term shape, may be a misprint of diameter. Translator's note] in a viscous varnish, for instance, super silica particles may be wetted with a solvent such as isopropyl alcohol, or may be mixed with a substance to which nonionic surfactant or anionic surfactant is added to adjust as a coating solution to enable to disperse above-explained super fine particles in the coating solution without cohesion. It is preferable when coating solution showing well dispersed state is adjusted by thoroughly dispersing while adding solvent small amount at a time to the fine abrasive particles which are wet and are sufficiently dispersed in the solvent to provide homogeneous state, and by further stirring thoroughly to reach a homogeneous state while adding a binder dissolved in the solvent small amount at a time , and by further using ultrasonic wave. It is recommended to filter thus adjusted coating solution with a 1 ~ 10 μm filter, and then, to remove secondary cohered abrasive particles through precipitation and then, to subject this to coating.

[0021]

Regarding this invention's binder, it is possible to use organic and inorganic composite resins, or prepolymer, oligomer, or polymer having siloxane bonding [siloxane bonding: $(-Si-O)_n$] within that structure. In addition, it is used as polysiloxane or their derivatives, or modified substance, or their blends.

[0022]

More specifically, it is possible to use blends or reaction products prepared by mixing or reacting monomer, prepolymer or oligomer, or polymer which constitute polysiloxane, for instance, monomers, prepolymers or oligomer, or polymers of acryl group resins, polyethylene group resins, polyvinyl chloride group resins, polyvinyl acetate group resins, polyvinyl alcohol group resins, polyvinyl acetal group resins, rubber-form polymers, polyester group resins, polyamide group resins, phenol group resins, amino plast [transliteration], epoxy group resins, polyurethane group resins, or cellulose derivatives and the like.

[0023]

According to this invention, it is particularly recommended to use prepolymer, or oligomer, or polymer of vinyl chloride-vinyl acetate group copolymer, polyethylene group resins, polyvinyl chloride group resins, polyvinyl acetate group resins, acryl group resins, polyurethane group resins, or polyester group resins as main chains, and to react through, for instance, graft polymerization prepolymer or oligomer, or polymer of siloxane to their side chains to form polymers comprising organic compounds as main chain portion and polymer, or prepolymer, or oligomer formed of siloxane binding as side chain portion. Through use of above-explained silicone group polymer for the binder in the polishing layer, it is possible to coat uniformly without partial cohesion of abrasive particles in the coating solution or in the polishing layer to form a polishing tape suited for super fine polishing of precision parts members .

[0024]

It is recommended to prepare said coating material by adding carboxylic acid salts such as zinc, manganese, zirconium, lanthanum, cobalt, or tin; or organic metal compounds such as alkyl titanate including tetrapropyl titanate, or tetra butyl titanate and the like for purpose of hardening the binder in the polishing layer. Furthermore, rate of addition of hardener based on 100 parts by weight reactive resin included in the binder is 0.001 ~ 3.5 parts by weight based on conversion to metals of said organic metal compounds, and 0.1 ~ 0.5 parts by weight in the case of alkyl titanate.

[0025]

Regarding coating solution for polishing tape, as illustrated in the Figure 3, on one side of , for instance, polyethylene terephthalate film (base film (5)) with 10 ~ 200 μm, or more preferably, 50 ~ 100 μm thickness, a primer layer (6) having the main component of epoxy resin, acryl resin, or polyester may be arranged as needed.

[0026]

Then, polishing layer of 0.5 ~ 10 g/m^2 (according to this specification, coating weight is described with solids: g/m^2), or more preferably, 3 ~ 10 g/m^2 is arranged by a gravure reverse method that uses gravure plat that is capable of regulating coating weight uniformly with good stability by doctoring action, and this is coated, dried, and hardened to form mesh-form cracks. In addition, this invention's binder that includes siloxane bonding promotes curing reaction with temperature and humidity. And therefore, it is preferable when the atmosphere during coating is as high as possible temperature and humidity. However, when it happens to be of extremely high temperature and high humidity, coating solution may harden on a gravure plane surface to cause uneven curing reaction of coated polishing layer to result in condensation reaction of the coating solution prior to coating to present gelling problem. And therefore, preferred conditions are 15 ~ 40 °C, and 30 ~ 60% relative humidity under the same temperature.

[0027]

In addition, a heat treatment that is equivalent to 40°C, and 300 hours is applied at 40 ~ 60 °C to correct distortion on the polishing layer with mesh-form cracks for purpose of completing correction of distortion by cracks and reaction to constitute a stable polishing layer.

[0028]

Average roughness (Ra) at surface center line of non-crack part in the polishing layer of polishing tape prepared in above-explained manner is within a range of 0.005 ~ 1.0 μm and this is suited as a polishing layer for precision parts and members having mesh-form cracks with pitch of 5 ~ 20 μm. In addition, it is possible to constitute polishing tape for precision parts members showing durability with improved grinding efficiency without causing grinding scratches on a to-be polished material.

[0029]
According to above-explained polishing tape, as illustrated in the Figure 4, this invention's polishing tape (4) is placed on a support body (9) comprising a rotary metal sheet through an elastic elastomer (8). As for the polishing work, on a polishing tape (4), for instance, end plane of optical connector ferule removed of cover part (3) of an optical fiber (2) is polished for about 30 ~ 60 seconds at about 60 rpm rotation rate. This invention's polishing tape having coated surface of super fine silica particles and fine cracks is capable of polishing with good efficiency without causing grinding scratches on a to-be polished surface. In addition, the worn polishing powder (21) which occur along with wear of polishing layer during polishing process is absorbed in cracks (20) which are present on the polishing layer (7) as illustrated in the Figure 2 to maintain absence of worn powder on the surface of polishing layer to prevent from occurrence of uneven polishing on the to-be polished surface or polishing scratches.

[0030]
This invention is further explained in detail below with examples.

[EXAMPLES] (EXAMPLES 1 ~ 6)
Silicone resin group varnish that is a condensate of organo alkoxy silane shown in the Table 1 and abrasive particles (organo silica sol) wetted with isopropyl alcohol were dispersed by ultrasonic wave , and this was filtered with 3 μm filtering precision to prepare a coating solution for polishing tape. Then, above-explained coating solution was coated as a polishing layer (7) on a Melinex 542 with 75 μm thickness that had been primer and easy adhesion treated (brand name of the base film (5), polyethylene terephthalate film made by ICI Japan (K.K), by using a plate (diagonal concave ( ) line plate, 95 lines/25 mm, 80 μm plate depth) through a gravure reverse coating method to give polishing layer (7) with 5g/m^2 thickness, and this was cured for 10 minutes at 100°C to give a polishing tape (4) with polishing layer (7) arrangement.

[0031]
[Table 1]

	silicone resin group varnish		abrasive agent	
example 1	KR-9218*1	5 parts by weight	IPA-ST	100 parts by weight
example 2	KR-213 *2	"	IPA-ST	"
example 3	KR-211 *3	"	IPA-ST	"
example 4	KR-212 *4	"	IPA-ST	"
example 5	*1/*3 =4/1	"	IPA-ST	"
example 6	*1/*4= 4/1	"	IPA-ST	"

[0032]
Resin varnish shown in the Table 1 has following characteristics:

- KR-9218 (silicone group resin varnish) made by Shinetsu Kagaku Kogyo K.K.
  includes 15% methoxy group, 100 % solids
- KR-213 (silicone group resin varnish) made by Shinetsu Kagaku Kogyo K.K.
  includes 20% methoxy group, 100% solids
- KR-211 (silicone group resin varnish) made by Shinetsu Kagaku Kogyo K.K.
  includes 4% hydroxyl group, 70% solids
- KR-212 (silicone group resin varnish) made by Shinetsu Kagaku Kogyo K.K.
  includes 5% hydroxyl group, 70% solids
- IPA-ST (organo silica sol dispersed in isopropyl alcohol)
  average particle diameter 0.001 ~ 0.15 μm, made by Nissan Kagaku Kogyo K.K,
  30% solids

[0033]

(COMPARATIVE EXAMPLE 1)
Coating solution for polishing tape of comparative example 1 having composition shown below was prepared:

- ceramic coating material Gulasuka HPC 7502 [transliteration] 30 weight %
  (organic/inorganic composite silicone resin solution)
  made by Nihon Gosei Gomu K.K. 30% solids
- organo silica sol 70 weight %
  average particle diameter 0.10 ~ 0.15 μm, 30% solids
  dispersed in isopropyl alcohol, made by Nissan Kagaku Kogyo K.K.

[0034]
(COMPARATIVE EXAMPLE 2)
Coating solution for polishing tape of comparative example 2 having composition shown below was prepared.

- ceramic coating material Gulasuka HPC 7502 [transliteration] 30 weight %
  (organic/inorganic composite silicone resin solution)
  made by Nihon Gosei Gomu K.K. 30% solids
- organo silica sol 70 weight %
  average particle diameter 0.10 ~ 0.15 μm, 30% solids
  dispersed in isopropyl alcohol, made by Nissan Kagaku Kogyo K.K.
- HPC404H (hardener) 5 parts by weight based on coating solution
  name by Nihon Gosei Gomu K.K., 30% solids

[0035]
(COMPARATIVE EXAMPLE 3)
Coating solution for polishing tape of comparative example3 having composition shown below was prepared.

- ceramic coating material Gulasuka HPC 7502 [transliteration] 30 weight %
  (organic/inorganic composite silicone resin solution)
  name by Nihon Gosei Gomu K.K., 30 % solids
- organo silica sol 70 weight %
  average particle diameter 0.10 ~ 0.15 μm
  dispersed in isopropyl alcohol, made by Nissan Kagaku Kogyo K.K. 30% solids
- carboxylic acid group dispersant 5 parts by weight based on 100 parts by weight coating solution, made by Nihon Gosei Gomu K.K.

[0036]
Coating solutions for polishing tapes of comparative examples 1 ~ 3 were subjected to a 5 μm precision filtration; and coating solutions explained above were coated on Melinex 542 used in the example by using a plate (diagonal line concave ( ) sheet 95 lines/25 mm, 80 μm plate depth) at 7g/m^2 by using a gravure reverse coating method, and they were dried at 100°C to prepare polishing tapes (4) with polishing layers (4) arrangement.

[0037]

Samples of examples and comparative examples were removed of adhesive agent by using a polishing sheet that uses silicon carbide to form spherical surfaces in accordance with ordinary polishing process, and were subjected to a coarse polishing with a diamond sheet. Then, as illustrated in the Figure 4, the polishing tape (4) was attached to a support body of polishing machine via elastomer; and this invention's polishing sheet was used to finish end plane of optical connector ferule of optical fiber (2) finished of coarse polishing for 30 seconds at 60 rpm rotation rate; and they were evaluated on the items shown below, and results are shown in the Table 2.

[0038]

[Table 2]

Evaluation results of examples and comparative examples

sample	surface characteristics		results of polishing				
	surface roughness (μm)	pitch (μm)	scratches	adhesion	reflection attenuation	missing part	border durability
example 1	0.17	20	o	o	good	o	o
example 2	0.18	10	o	o	good	o	o
example 3	0.17	10	o	o	good	o	o
example 4	0.16	15	o	o	good	o	o
example 5	0.15	20	o	o	good	o	o
example 6	0.16	20	o	o	good	o	o
comparative example 1	0.04	* not recognized	o	o	good	x	Δ
comparative example 2	0.04	* not recognized	o	o	good	x	Δ
comparative example 3	0.05	* not recognized	o	o	good	x	Δ

* not recognized: crack occurrence not recognized

Evaluation standards:
o : very good
o : good
Δ : some problems for practical application, but being used

[0039]

Each sample of examples and comparative examples was subjected to final finish on end plane of optical connector ferule (11) of optical fiber (2) illustrated in the Figure 4; and results showed that the ferules polished with samples of examples 1 ~ 6 displayed finish precision with absolutely no polish scratches or uneven polish; and in addition, durability of the polishing tapes was good to enable efficient work to provide optical connector ferules showing good signal attenuation characteristics. To these, when final finish on end planes of optical connector ferules was conducted by using those of comparative examples in the same manner as explained in the examples, results showed although no occurrence of polish scratches or uneven polishing, fine missing parts occurred at the border part of fiber and ferule. In addition, durability of polishing tapes in comparison with that of the examples showed about 80% in the case of comparative examples.

[0040]

[EFFECTS OF THIS INVENTION]

As explained in details above, this invention's polishing tape that uses linear cracks and fine abrasive particles with 0.005 ~ 0.03 μm provides good finish precision as well as durability with absolutely no polish scratches and uneven polishing to optical connector ferule, and allows efficient works. In addition, it shows effects of not causing polish scratches or uneven polishing on prevision parts members such as optical connector ferule or optical reading head and the like to indicate possible finish with good signal attenuation characteristics and efficiency.

[BRIEF EXPLANATION OF THE FIGURES]

[FIGURE 1]

(A) It illustrates a conceptual diagram that shows cracks and unevenness ( ) on the polishing layer of polishing tape.

(B) It illustrates a conceptual diagram that shows cross section of polishing tape laminate.

[FIGURE 2]

It illustrates a conceptual diagram of a state where grinding powder is adhered to cracks after use of polishing tape.

[FIGURE 3]

It illustrates a cross sectional schematic diagram of other structure of polishing tape.

[FIGURE 4]

It illustrates a cross sectional schematic diagram of a state when polishing tape is placed on a pad and is used for polishing.

[DESCRIPTION OF CODES]

1 optical connector ferule
2 optical fiber
3 covering part
4 polishing tape
5 base film for polishing tape
6 primer layer
7 polishing layer
8 elastic elastomer
9 support body
11 end plane of optical connector ferule
20 abrasive particle
26 worn polishing powder
30 non-crack part
35 pitch of crack
70 mesh-form crack

Figures 1 through 4

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